UAVS FOR AGGREGATES
A look at drone use in pits and quarries
How the top 5 aggregate companies gather aerial intelligence

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Flying high

Drone popularity continues to soar

When travelling across Canada to visit pits and quarries for features in Rock to Road, it’s not unusual for a producer to tell me that they have implemented a drone program as part of their operations – either through purchasing a machine and training staff or by hiring a professional contractor to obtain all the data they require.

The growing popularity of unmanned aerial vehicles (UAVs) in the aggregate sector comes as no surprise to me. In addition to hearing about all the great ways they save operations time and money, the aggregate sector seems to simply be following the same trend as many other commercial sectors around the globe.

According to a MarketsandMarkets' research report, the global UAV drones market is projected to grow to US$21.23 billion by 2022, at a compound annual growth rate (CAGR) of 19.99% between 2016 and 2022. The commercial drone market is expected to hold the largest market share with sensor components projected to experience the highest rate of growth. The North American market for commercial drones is expected to grow exponentially during this time period.

It’s no surprise that aggregate producers would be part of this growing market. After all, a good drone operator with the right equipment and experience analyzing the collected data – whether they are an employee or a contractor – can look after a lot of the volume and mapping needs for producers, create annual operating reports and assist in the generation and renewal of conservation reclamation business plans (CBRPs). And once LiDAR can be fully combined with drone technologies to map tree-covered areas, the advantages of these technologies for producers will only continue to grow.

When it comes to the advantages of drones for aggregate production, the sky is the limit.
John Deere partners with Kespry

John Deere and Kespry have announced an exclusive global strategic alliance through which John Deere Construction & Forestry dealers will provide the Kespry Aerial Intelligence System to their customers on job sites around the world. Starting in North America, the alliance enables John Deere customers to use Kespry’s fully integrated industrial drone platform to capture topographic data in minutes with survey-grade accuracy.

“This technology will help our dealers offer a seamless workflow to site development and road building contractors from project planning through grading dirt,” said Andrew Kahler, product marketing manager, John Deere WorkSight. “The data gathered from the Kespry system will help our customers and equipment operators make decisions that reduce costs and improve productivity as they optimize the job site and spend less time on jobs.”

“Our relationship with John Deere will accelerate the adoption of drone solutions in industrial markets and will rapidly change how business is done in construction, road building and other industrial sectors,” added George Mathew, chairman and CEO of Kespry. “These advanced aerial intelligence systems are already changing the face of work in industrial markets as surveyors and contractors are able to retool their skill sets for this increasingly connected world.”

Trimble and Propeller Aero collaborate to deliver UAS workflows

Trimble recently announced that it is collaborating with Propeller Aero to distribute its Unmanned Aircraft System (UAS) analytics platform.

Propeller, based in Sydney Australia and Denver, Colo. is a leader in the advanced collection, visualization and analysis of data from UAS. Propeller’s simple automated ground control targets, cloud-based visualization and rapid analysis platform will also be integrated with Trimble Connected Site solutions to bring an end-to-end cloud-based UAS solution to civil engineering and construction contractors.

Pairing Propeller’s web-based interface with Trimble Connected Site solutions allow users to unlock the full value of UAS information. It gives users access to simple tools to measure surface geometry, track trends and changes across time and perform visual inspections. Both technical and non-technical professionals are now able to gather insights remotely and collaborate, driving significant improvements in safety, efficiency and reducing environmental impact across a construction worksite.

“Propeller combines ease of use with powerful analysis tools that allow users to view 2D and 3D deliverables and extract valuable information,” said Scott Crozier, director of marketing for Trimble Civil Engineering and Construction. “Like Trimble, Propeller understands the value of quality and accurate data for integration with civil engineering and construction workflows.”

“We pride ourselves in taking the most trusted, technical data and tools and wrapping that up in an easy-to-use online platform that is relevant to the entire organization, not just technical users. Working closely with Trimble demonstrates a shared commitment to achieving that vision,” said Rory San Miguel, CEO of Propeller Aero. “Integrating our platform into Trimble’s Connected Site solutions will bring a new class of information to construction sites and organizations globally.”

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Kespry upgrades Drone 2 system

Earlier this year, Kespry announced that it has enhanced the Kespry Drone 2 with higher performance features that deliver significantly greater accuracy and reliability. These enhancements make Kespry Drone 2 ideal for a wide range of industrial applications, including those requiring survey-grade precision, such as in mining and the architecture, engineering and construction (A/E/C) markets. The new Drone 2 now achieves four to six times the accuracy of the previous Kespry Drone System.

By adding a high-performance ground receiver, the Kespry Drone 2s can deliver accuracy of 2 cm to 10 cm. The Global Navigation Satellite System (GNSS) base station receiver serves as a single survey control point. During flight, imagery from the Drone 2s and data from the base station are collected simultaneously. Both data sets are automatically uploaded for processing in the Kespry Cloud where accurate survey-grade data is automatically generated.

Such degrees of accuracy are critical for mine planning, determining boundary lines, positioning underground utility cables and pipes, and other survey-grade applications. The single ground control point simplifies survey applications as it eliminates the need for multiple control points and additional manual measurements in the survey process.

Post-Processed Kinematic (PPK) technology is used to increase the accuracy of photogrammetric aerial images. Integrating PPK improves the speed, efficiency and reliability of gathering survey-ready data in commercial and industrial environments.

Feds release UAS draft regs for visual line of sight

The Government of Canada has released draft regulations for unmanned aircraft systems (UAS or drones) operations for public comment in Canada Gazette Part One.

This is a major milestone in the evolution of global industry where Canada has a leading position. Eleven years ago, Unmanned Systems Canada initiated formal discussions with Transport Canada (TC) to develop UAS regulations in anticipation of the development of a significant new commercial market for Canadian industry.

This milestone announcement will establish a regulatory environment for UAS operations within visual line of sight, building upon the procedures developed and refined over the past decade. During this period, some 10,000 special operating certificates have been issued by TC for commercial UAS operations under regulatory guidelines, with a rapid increase in approvals over the past four years. These operations have enabled entrepreneurs to establish new businesses, develop customer bases, and reshape how business is done in numerous applications. This year, the Canadian UAS industry is expected to generate revenues approaching $1 billion.

As these draft regulations address Visual Line of Sight (VLOS) operations, it is recognized that the future of the industry is dependent on the ability to operate Beyond Visual Line of Sight (BVLOS) in a wide variety of applications that suit Canada’s vast geography and natural resources. This announcement lays the groundwork for continuing to open up Canada’s industry through our regulatory process.

With 1,000 companies established in this dynamic new Canadian industrial sector, this regulatory announcement will further mature and enable the industry to move forward to safely and effectively implement new technologies in numerous markets, driving the creation of new high-quality jobs and economic growth.

Unmanned Systems Canada encourages industry and other stakeholders to review the proposed regulations and submit comments, either individually or, to Unmanned Systems Canada as part of a collective response. The association will continue to provide the industry with resources and representation at this critical time.

Source: Unmanned Systems Canada.

Unmanned Canada 2017 coming to Toronto

Join aerospace professionals, researchers, knowledge brokers, and policy and decision makers at Canada’s premier national conference and trade show showcasing Canadian sector capabilities. With over 70 speakers and 350 attendees, this is the place where ideas are exchanged and connections and business opportunities are made.

This three-day event offers an opportunity to network and connect with key industry decision-makers, supply chain representatives and technology innovators.

“Founded by a small group of entrepreneurs and visionaries, Unmanned Systems Canada focuses on enabling the growth of the Canadian unmanned vehicle systems community through education, advocacy, and the exchange of ideas and technologies,” said Mark Aruja, Unmanned Systems Canada chairman. “Each year our annual conference helps to further that mission. Unmanned Canada 2017 presents an unparalleled opportunity to exchange knowledge, create and renew a global network of colleagues and business contacts and showcase innovative technology and services. I look forward to welcoming you this November.”

Topics during the conference will include:
• Drone countermeasures;
• Civil and commercial applications;
• Beyond Visual Line Of Sight operations;
• Legal issues and ethics;
• Sensors and data integration;
• Regulations developments and experience;
• Data analytics;
• R&D/Emerging technologies;
• Law enforcement and military applications;
• Automated vehicles;
• Training and simulation; and
• Data security and privacy.

To register or learn more, visit www.unmannedsystems.ca.
Buying a drone for a new mapping program at the enterprise level can be confusing. With all of the options available, figuring out what your business needs means asking the right questions. Here are five questions – and five important considerations – to help you evaluate drones for mapping.

#1. HOW EASY IS IT TO FLY?
If your company is investing in a new drone program, one of the first things you’ll need to determine is who will be responsible for flying. If you don’t have a pilot already on your team and you don’t wish to hire new people from outside of your industry, ease of use will be an important feature to look for. Consumer and prosumer drones can be difficult to fly and expensive to crash.
Commercial drones with real automation features allow anyone to fly well, and even take care of the obstacle avoidance.

**#2. HOW ACCURATE IS IT?**
Different types of drones provide different levels of accuracy. Make sure your purchase can provide the data you need by asking about the type of sensors available and the accuracy of the output. High-quality topographic maps suitable for design and other industrial purposes require a professional drone, one that carries professional grade cameras and can deliver repeatable survey grade accuracy. Look for sophisticated systems that can be configured to maximize the quality of imagery for your job type.

**#3. HOW DO I END UP WITH ACTIONABLE DATA?**
The drone is only one part of an aerial intelligence platform: it captures the data, but you’ll need a platform to turn that data into actionable insights. A standalone drone purchase will require that data be uploaded to a separate system for processing. That transfer can require moving SD cards around. Some customers are gravitating towards single vendor solutions, which provide tight integration between the pieces of the system, and transfers data wirelessly, removing the need to deal with SD cards or other peripherals.

**#4. WHAT KIND OF CUSTOMER SUPPORT IS AVAILABLE?**
Support is an important component of any enterprise program, and drones are no different. Most consumer and prosumer drone companies are based overseas; few provide support or training programs appropriate for business. Support for your drone program may involve more than just hardware issues: you’ll need to work through regulations, flight planning tools, and figure out how to process the data once it’s captured.

When choosing your drone mapping system, make sure you ask lots of questions about how the provider solves problems and complications.

**#5. WHAT’S THE ROI?**
When purchasing a drone for commercial applications, the price of a drone is less significant than the return on your investment (ROI) and total cost of ownership (TCO). Look closely at staffing requirements, quality of deliverables, and risk factors. Flight planning, data processing, and delivery systems will also have to be supplied. TCO is another significant consideration to bear in mind. The original purchase price of the drone can sometimes be kept low with ‘per flight’ costs designed to supplement that perceived saving. To get value out of your drone and data solution, you’ll likely want to fly regularly, so these per flight costs can add up quickly.

You also need to take into account depreciation on the equipment if you’re buying it outright. Commercial technology advances quickly, so the shelf life of your drone could be as little as 18 months before you have to buy again.

There’s a lot of information available about drones for mapping, but at the enterprise level, the most important consideration often isn’t the drone – it’s the actionable data you get from the map and the reliability with which you can keep getting it on a daily basis.

Asking the right questions can ensure that you’re getting a solution that can deliver.

Rosalie Bartlett is the editor of Drones at Work and on the marketing team at Kespry.
Les Helm has been working in Canada’s resource sectors as long as he can remember. His father, who worked as a logger in the Ucluelet, B.C. on Vancouver Island, first introduced him to the forestry sector as a small child. Helm quickly followed in his father’s footsteps, joining him in the bush.

“I started in road building when I was 14,” Helm recalls during an interview at his office in Lac La Biche, Alta.

Growing up, he continued working with his father learning the ins and outs of the logging business and enrolled at British Columbia Institute of Technology (BCIT) after high school, and graduated from BCIT’s forestry program in his early 20s. Since that time, Helm has worked a wide variety of forestry and other resource-related jobs including spacing, layout, planting, layout...
of salvage timber and road layout and engineering in B.C. and Alberta, and has run three businesses of his own over the years.

It was his experience in road building and forestry combined with his entrepreneurial spirit that led him to opening up Silver Sage Enterprises eight years ago, a consulting business that looks after gravel pit needs for aggregate producers in northern Alberta.

Fast-forward to present day and Silver Sage has expanded dramatically. Helm’s company now oversees 79 pits across northern Alberta from licensing to reclamation.

“Basically I work all of northeastern Alberta,” Helm says. “I work all the way to Wabasca to Fort McMurray and all the way to Cold Lake and Bonnyville.”

To help look after the needs of a significant number of those pits, Helm hired UAV and mapping and volumes specialist James Donaldson of Skyridge Solutions.

“Anyone can fly a drone, it’s what you can do with the data that’s important,” says Donaldson, who flies using a senseFly eBee RTK fixed wing drone equipped with a Geneq G10 GPS Base Station. “When we started the company we looked at a fixed wing drone versus a quad copter and decided on the fixed wing because it can cover more ground in a single flight. Gravel sites are usually very large and this makes us more efficient. Fixed wings also perform and deliver better results if it’s windy; and ours have the built-in RTK system so we eliminate the need to put down ground control points.”

Donaldson uses a handheld GPS unit to tag the piles with product info, such as topsoil, subsoil, overburden and product, for example.

“This is pretty important for the reclamation and monitoring of the site,” he explains. “I walk around with a submeter GPS, identify the material and add it all to the maps. Anyone can tell you how much is in the piles these days, but operators need to know what’s in the piles, too.”

Donaldson uses the data he collects to produce annual operating reports for each pit. The operating reports he provides save Helm a great deal of time – and his clients money – because he no longer has to walk entire pits and GPS every pile.

“It takes quite a bit of time to walk a whole active operating area; it is going to cost me a 12-hour day, and then I have to download that data and then I have to process it,” Helm explains. “Now I can get an operating plan done each year and all I have to do is spend my time on expanding on whatever James flies and finds out. If I’ve got issues, I’ll spot them with his data instead of me taking all that time to walk in there. Now I know where I need to go when I’m working in a pit.”

RECLAMATIONS

Silver Sage also plans on using the data it receives from the service provided by Skyridge Solutions for renewals of the conservation reclamation business plans (CRBP). These plans contain all the information on a pit including all the maps and cross-sections as well as any First Nation consultations. Helm says the data he obtains is a big help for working with his clients on continuous reclamation planning.

“Now my topsoil piles and subsoil piles can be identified,” he says. “If I can do this, then on Skyridge’s operating plans that James flies every year, it’s going to show the progressive reclamation [of a pit].”

The UAVs can also be used to identify bad sections within the reclamation that might require transplant islands, where producers can bring in some fresh topsoil with healthy seeds so it will sprout up again.

ROLE OF LIDAR

The role that LiDAR will play when combined with UAV technologies for managing pits has yet to be defined in Alberta.
“Our problem here is that there hasn’t been any standards or procedures to it, so there’s no defined way of reading it yet; as they know it,” Helm explains.

Helm would like to be able to combine LiDAR with drone technologies so he can cover heavily treed areas.

“The drone is great for all my open pits, and it’s great for my active excavation, but it can’t help me at all yet [for tree-covered areas],” Helm says. “I say ‘yet’ because you know [industry] is going to come up with something.”

Producers and consultants aren’t the only ones interested in using LiDAR technology on UAVs. The combination could also significantly improve provincial governments’ abilities to manage their pits.

Although the government would not be able to use UAVs to manage volumes being taken out of pits that are already active, it could oversee the volumes in a new pit, Helm says.

“But this will only work when the data is there,” he explains. “Right now, if a pit is totally treed they’re not going to get it. But once the technology catches up where they can get an accurate LiDAR reading of a pit, you bet that’s something they’re going to be using.”

CHALLENGES AHEAD

Helm says educating individuals and companies on the benefits of the drones has been one the challenges he’s encountered since introducing the technology to his consulting business.

That said, as long his consulting business and its implementation of UAVs are helping producers stay in the black, then he expects Silver Sage and Skyridge Solutions to continue to prosper.
It was just a few months ago that JF Gabanna, director of business development for Interoute Construction Ltd. (a subsidiary of Terus Construction), first got his hands on a drone. Sure, he had seen a local company make its case for using the emerging technology, but it wasn’t anything that was completely on his radar.

That changed when management at Terus Construction informed staff that the new tool would be incorporated into the operation.

“Our sister operations in Alberta were using drones before our B.C. operations,” Gabanna says from his office in Crescent Valley, a small community nestled in the Kootenays in southeast B.C.

One company recognizes the financial benefits of investing in drones

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UNDERSTANDING THE TECHNOLOGY
Over the past few months, Gabanna and his team have been doing some training with their colleagues in Alberta in order to gain a greater appreciation for how the technology works, and how it can benefit the operation.

For starters, an entire site can be surveyed in, at most, 30 minutes from start to finish. That covers each pit/quarry, most of which have 6-12 stockpiles. That is a significant reduction over
the hours it can take to manually check each stockpile throughout the site.

“We have a lot of gravel pits and gravel stockpiles,” Gabanna says. “The idea is for us to be able to manage our inventories and have stockpile surveys done a lot quicker.”

Once the drone has captured the site visuals, the operator is able to go on to the Kespry site to access their data (Kespry hosts the data for you as part of the cost of the drone). Once the site visual has been loaded, a polygon tool is used to outline the rough limits of the pile. The operator sets the elevation points around the pile to tell the program what level is ground and, within seconds, you are able to find out the volume of the pile. Also, there is an option to input density to gain a weight measure of the pile as well. At the end of the day, you end up with accurate readings in metric units to provide a comprehensive understanding of exactly how much material is in the stockpile.

In addition to the benefit the drone provides in stockpile management, it also provides the ability to provide detailed information on the contours of the site, providing the site manager with the information for proper site planning.

IMPROVED SAFETY
There are also serious safety considerations to factor in with the use of drones for stockpile management. First of all, the operator can set up and launch the drone from the periphery of the operation, far removed from the machine operations and materials movement throughout the bulk of the pit or quarry. Secondly, there is no more need for the surveyor to work their way onto the stockpile with equipment in tow, eliminating the risk of injury that can occur from falling down while trying to climb up the aggregate stockpile.

“Getting a machine to fly over the piles, versus having one of our guys walk all of the piles is far less hazardous for our staff,” says Gabanna.

And from the early trials, there is no question of accuracy.

“Our experience in Alberta has been that the stockpile reports are consistently accurate with what we had in the past,” Gabanna says. “Our numbers are pretty much identical between surveys and test flights.”

LOOKING FORWARD
Terus will incorporate three drone kits into its B.C. operations, one for each of the primary regions that the company works in (northwest, northeast and southeast).

With drone use becoming a cost-effective stockpile management for quarries and pits, and helping to also eliminate a major safety issue, it’s only a matter of time before more companies make drones an integral piece of equipment for their day-to-day operations.

This article originally appeared in the May/June 2016 issue of Rock to Road.
UAV options: To buy or to rent?

Weighing the costs of UAV ownership for aggregate operations

When contemplating utilizing UAV/aerial applications in any operation, one of the first decisions required is whether to purchase a drone, or engage the services of a drone service provider. The following are some points to consider, if purchasing:

EQUIPMENT

Depending on your application, you will want a fixed wing UAV for large, open area projects. Or if you operate in smaller, confined areas, a VTOL multi-rotor may be a better option.

COST

The Internet and media are flooded with cool looking “hobby” drones that you can buy starting at about $1,000. If you are planning on using a drone for any surveying/mapping projects, you will need a UAV designed to carry larger specific payloads. You can expect to pay in excess of $30,000 for a survey grade UAV. In addition, the support equipment (imaging equipment, base station, computer, extra batteries, transportation equipment) can easily double the cost of the UAV.

REGULATIONS

In Canada, Transport Canada regulates the commercial use of all UAVs (regardless of size). All commercial use of UAVs in Canada requires both the crew (minimum two trained persons) and the UAV to be certified. The regulations are constantly changing, and proposed new rules will place even more onus on the commercial application of UAVs. As part of Transport Canada regulations, commercial UAV liability insurance is also required.

TRAINING AND PERSONNEL

Not only is it required by Transport Canada that UAV crews be properly trained, but, as with any equipment, competency training is necessary. Along with understanding and acquiring skills to operate the UAV and imaging equipment, proper and efficient workflow and operating procedures must be developed. In areas of low employee retention, the constant training of new employees could become a significant expense.

DATA PROCESSING

All of the equipment, training and data acquisition are only half of the equation. Without the software, computers and data processing knowledge to process the data, flying UAVs is just a hobby. Alternatively, there are offshore processing services that will process the data. This means less capital outlay, but fewer options and loss of control.

MAINTENANCE AND REPAIRS

Even for the experienced pilot, damage is inevitable. During the training phase it is not uncommon for an inexperienced pilot to have numerous crashes costing thousands of dollars in parts, not to mention lost time. As for maintenance, batteries have maximum charge cycles, and depending on use, will last about one year. The LiPo batteries used in UAVs can cost hundreds of dollars each. Due to the harsh environment most commercial UAVs operate in, much of the electronic equipment on board is prone to failures that can potentially cost several thousand dollars a year.

UTILIZATION

As with any acquired skill, without regular practice it is difficult to maintain peak proficiency. Unless the crew is operating once a week, not only will their skills suffer, but a significant capital asset and training investment is not being utilized.

> "If you choose to engage the services of a professional UAV service provider... ensure they are certified and insured."

If you choose to engage the services of a professional UAV service provider, the only thing you need to do is ensure they are certified and insured.

Murray Hunt is the president and chief UAV pilot for High Eye Aerial Imaging, a UAV service provider based in Ontario. This column first appeared in Ontario Miner.
THE 6 BIGGEST USES OF DRONE DATA IN CONSTRUCTION

BY ROSALIE BARTLETT
Construction companies are using drone data in so many interesting ways. From the pre-construction survey to the as-built survey, here’s a look at the six biggest uses.

1. PRE-CONSTRUCTION SURVEY
   Initial drone flights are surveying site conditions to document the baseline topography and pre-existing features. Data is exported into CAD or GIS software packages for civil designs.

2. 3D VIEW
   Rich 3D models allow for safe inspection of dangerous terrain. Construction project managers are locating and documenting features that might affect operations.

3. EARTHWORKS—PLANNING
   In the planning phase, the data is used to calculate distances, areas, and volumes. Data is exported and used for RFPs, takeoffs and project planning.

4. EARTHWORKS—DOCUMENTATION
   As the construction site progresses, the need for accurate and streamlined documentation increases.
   The types of drone data included in the documentation include:
   - Time stamped and geotagged imagery for each flight.
   - Installation of materials.
   - Dimensions for excavations of trenches and foundations.
   - Elevations for compaction/density tests on lifts and surfaces.

5. EARTHWORKS—MATERIAL MANAGEMENT
   Drone data helps with daily progress tracking and onsite asset management, by providing:
   - Accurate cut and filled volumes across the entire site.

   - Volume comparison of excavation of fill areas for a single site or multiple sites.
   - Data that can easily be exported to software programs used for generating surfaces in machine control projects.

6. AS-BUILT SURVEY
   During the project closure phase, data is used for documenting final grading and drainage, as well as completed site conditions.
   If you’d like to discuss how drone data can add value to your operation, contact us.

Rosalie Bartlett is the editor of Drones at Work and on the marketing team at Kespry. Images: Kespry.
Using drones to assist with conservation and reclamation business plans

When acquiring Surface Material Leases (SMLs) in Alberta, there are many regulatory steps that operators must go through prior to receiving government approval to extract aggregate resource on Crown land. One of these steps is for the applicant to develop a Conservation & Reclamation Business Plan (CRBP), which is essentially a detailed plan describing how the applicant plans to develop the aggregate resource and resolve any related environmental and/or land-use issues. The CRBP details the operator's sequential plans for site development, operation and final reclamation and must include related plans, diagrams and cross sectional drawings to provide a visual representation of this throughout the life of the operation.

As per Alberta Environment & Parks’ Guideline for Acquiring Surface Material Dispositions on Public Land, the applicant must provide pre- and post-development cross sectional drawings to show the pit and adjacent areas in profile. These drawings must show the surface landscape, thickness/volumes of topsoil, overburden and extracted resource material on site. This is where UAVs come in. AERIUM Analytics is now working closely with The Lorrnel Group (TLG) to acquire accurate pre- and post-disturbance data to build more detailed and accurate cross sectional models to include in operators’ CRBPs.

TLG has been approached by many operators in Alberta to support them in both new SML applications, as well as lease renewals on historical SML sites that have been partially extracted. For those looking to apply for a new SML, gathering accurate baseline data on topography is critical in developing pre-development drawings. It is now possible to create accurate topography and contour mapping using UAVs and the basic principles of photogrammetry, which is the process of turning multiple 2D images into high-resolution ortho images and 3D models, or LiDAR. These 3D models are then used to create pre-disturbance cross sections and help in designing long-term operational and reclamation plans. Operators are now able to utilize UAV technology to more accurately design the phases of resource extraction, soil and overburden stockpile volumes and location, slope design and surface water management.

In many situations, operators find themselves having to renew expiring SMLs in order to continue extracting resources on Crown land. Renewals have become even more of a complex scenario in that current site conditions often differ from the original CRBP plans that were in many cases submitted decades ago. Often TLG find that CRBPs require substantial redesign in order to meet regulatory requirements. For these situations, UAVs have become an invaluable tool and have enabled operators to gather real-time data on current site conditions. Operators and consultants are able to acquire accurate pre- and post-disturbance data to check for any deviations or changes that are required in operational and reclamation plans.

Once a Crown lease application or renewal is approved, operators are then required to submit annual operating reports (AOR) to the government, which provide updates on operational activity. Questions such as total area of lease that has been cleared on vegetation, total area of extraction, total area under reclamation, average depth of area extracted, must all be answered in the AOR. It is often difficult for operators to accurately answer these questions and as such, this often results in absent or deficient AORs. Again, UAVs are quickly becoming a tool for obtaining such data. Yearly UAV data collection enables operators to provide accurate AOR data while monitoring operational development to ensure that activities are compliant and in line with their CRBP.

Upon final reclamation, UAVs can also be used as a final measure for comparing closure plans to original CRBPs. Local government land use officers will often assess these conditions prior to issuance of a Reclamation Certificate and as such operators are quickly realizing the potential for assisting this process.

UAVs and the use of photogrammetry are becoming attractive solutions to many operators across Canada. It is enabling more accurate and consistent planning even outside of public land applications and CRBP requirements. UAV technology allows for the acquisition of more data quicker, while decreasing safety risks of working in and around active pit operations. Data acquired through UAVs will continue to be used in many ways to support pre-planning, operational management, and final reclamation for years to come.

Martin Baker is the manager of land and environmental services with The Lorrnel Group, a sister company of AERIUM Analytics.